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| 09/966,157 | 09/28/2001 | Isaiah O. Oladeji | Jessen 7-1-4/-75903-023 | 4091 |

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EXAMINER

GUERRERO, MARIA F

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

2822

DATE MAILED: 06/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

A 7-

Office Action Summary

Application No.

09/966,157

Applicant(s)

OLADEJI ET AL.

Examiner

Maria Guerrero

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 1-5 and 26-29 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>7,9</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to the Amendment filed March 24, 2003.

Claims 1-29 are pending.

Election/Restrictions

2. This application contains claims 1-5 and 26-29 drawn to an invention nonelected with traverse in Paper No. 5. A complete reply to the final rejection must include cancelation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Information Disclosure Statement

3. The information disclosure statements (IDS) filed on January 13, 2003 and March 24, 2003 have been considered by the examiner.

Claim Objections

4. Claims 11-12 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 11 recites "the method of claim 11".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 6-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6 recites "etching a trench within the mask layer, through the metallic mask film, **without exposing the low-k dielectric material to a predetermined depth of the low-k dielectric material**". The claim is vague and indefinite.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 6-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al. (U.S. 6,312,874) in view of Usami (U.S. 6,274,483).

Chan et al. teaches a method of forming a dual damascene interconnect structure having a low-K dielectric material deposited over an underlying metal layer (Fig. 3a, Abstract). Chan et al. discloses forming a first mask layer (52) (silicon oxide)

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on the low-K dielectric material (50), forming an intermediated mask layer (54) made of silicon nitride on the first mask layer (52) (col. 5, lines 10-15).

In addition, Chan et al. teaches the low-k dielectric material is still protected by the first mask layer (52) and the multiple layer mask (58) (Abstract, Fig. 3c-3e). Chan et al. teaches etching each mask layer selectively without etching the rest of the layers and selectively etching the low-k dielectric material (Fig. 3a-3e, col. 5, lines 45-67, col. 6, lines 5-25). Chan et al. teaches etching a trench with the mask layer and after etching the trench then etching a via to the underlying metal layer (Abstract, Fig. 3a-3i).

Furthermore, Chan et al. teaches etching a first feature on the mask layer without exposing the dielectric material, etching a second feature on the mask layer without exposing the dielectric layer (Fig. 3a-3e). Chan et al. discloses transferring the first and second features to the dielectric layer and etching the dielectric layer (Fig. 3e-3i). Chan et al. shows depositing a conductive metal in the first and second features, planarizing the conductive metal and removing the mask (Fig. 3j, col. 6, lines 50-67).

Chan et al. does not specifically show forming the metallic mask film over the barrier mask film. However, Usami discloses forming a silicon dioxide film (or silicon carbide) (24) over the low-K dielectric material (23), forming a mask (35) (barrier mask film), forming a metallic mask film (37) over the mask (35) (Fig. 4A, col. 9, lines 62-67, col. 10, lines 5-22).

Usami shows the metallic mask film comprising: titanium, tantalum, tungsten, titanium nitride, and tantalum nitride (col. 5, lines 45-49). Usami discloses the first and second metal masks are stacked together to form the metal mask (Fig. 4C, col. 10, lines

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15-22). Usami depositing a conductive metal within the via and the trench on the low-k dielectric material (Fig. 6A, col. 11, lines 53-60). In addition, Usami shows planarizing the conductive metal and removing the mask (Fig. 6A-6B, col. 11, lines 57-65).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chan et al. reference by specifying the use of the metallic mask film as part of the mask layer as taught Usami. The modification would provide a process of forming a good quality dual damascene structure using a multiple layer mask ensuring the protection the low dielectric constant material during the photoresist removal process and the via would maintain desired width minimizing misalignment. The combination is proper because both references are solving a common problem (Usami, col. 3, lines 64-67; Chan et al., Abstract, col. 3, lines 64-67).

Response to Arguments

7. Applicant's arguments with respect to claims 6-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Guerrero whose telephone number is 703-305-0162.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-49055. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

MG
MG
May 28, 2003


AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800